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CD NO.

SUPPLEMENT TO
REPORT NO.

THIS IS UNEVALUATED INFORMATION

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When stoker firing is used, the equivalents for gas and long-flame coals have been established without regard to whether the coals are burned in pure form or in mixture. For the other types of fuel the equivalents have been established taking into account the burning of these fuels in mixture.

For hand firing, equivalents have been established for fat, sintering, long-flame, gas, and coking coals independently of their being burned in pure form or in mixture. For the other types, equivalents have been determined taking into account their being burned in mixture.

It must be kept in mind that since the efficiency of the boiler is a function of Z_K (the amount of steam in kilograms produced per square meter of heating surface) and γ (the amount of fuel in kilograms expended per hour per square meter of firebox grating), the magnitude of the equivalent of a given fuel must also depend on Z_K and γ .

For instance, tests run in 1942 to determine equivalents for Kuznetsk coals on the Tomsk Railroad System with a series Em locomotive gave the following results:

Type of Coal	Z_m (hourly expenditure of steam, in kg, in machine of locomotive per sq m of heating surface)					
	<u>25</u>	<u>30</u>	<u>35</u>	<u>40</u>	<u>45</u>	<u>50</u>
PS Anzhero-Sudzhensk	0.718	0.705	0.690	0.674	0.649	0.612
PS Kemerovo	0.699	0.606	0.689	0.675	0.655	0.624
PS Prokopyevsk	0.639	0.631	0.622	0.612	0.602	0.589

Under operating conditions, however, the value Q_H^p for a given type of fuel will not remain constant, but will vary in dependence on the ash content, moisture content, etc.

Therefore, the equivalents shown in the following tables should be regarded only as orienting points corresponding to the average conditions of locomotive operation.

The following table gives the fuel equivalents for stoker-fired locomotives in relation to 7,000-calorie fuel used in fireboxes having standard grates and domes, and where Z_K equal 60 kilograms per square meter per hour. [Q_H^p is the lower calorific value of the burning mass, expressed in calories per kilogram.]

Table 1

<u>Fuel</u>	<u>Type</u>	<u>Q_H^p</u>	<u>Q_H^d</u>	<u>η_K</u>	<u>β</u>
Donets coal	D	7,340	5,560	0.645	0.512
Donets coal	G	7,730	6,410	0.596	0.546
Donets coal	PZh	8,060	6,770	0.548	0.525
Donets coal	PS	8,220	6,830	0.450	0.439
Donets coal	PS P/K	8,245	6,246	0.400	0.378

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Table 1 (contd)

<u>Fuel</u>	<u>Type</u>	<u>QH</u>	<u>QH</u>	<u>TK</u>	<u>Э</u>
Donets coal	T	8,280	7,210	0.288	0.297
Donets briquette	Mospino station	8,320	7,570	0.528	0.571
Donets briquette	Khanzhenkovo station	8,380	7,790	0.528	0.588
Donets briquette	Yenakiyevo station	8,290	6,980	0.510	0.509
Donets anthracite	AM	8,000	6,690	0.593	0.567
Donets anthracite	ARSt	7,970	6,590	0.523	0.492
Moscow coal	Avg	6,730	2,890	0.478	0.197
Kizelovskiy coal	G/PZh	7,830	5,690	0.630	0.512
Chelyabinsk coal	Avg	6,710	4,130	0.585	0.345
Karaganda coal	PZh/PS	8,020	5,220	0.635	0.564
Karaganda Fedorovskiy coal	PR	6,855	4,530	0.612	0.396
Siberian Leninsk (Kol'-chugino) coal	G	7,880	6,765	0.610	0.590
Siberian Leninsk (Kol'-chugino) coal	D	7,400	6,275	0.610	0.594
Siberian Prckop'yevsk coal	SS	8,150	6,795	0.612	0.587
Siberian Kiselevsk coal	SS	7,980	6,870	0.595	0.564
Siberian Anzhero-Sudzhensk coal	PS	8,340	7,225	0.450	0.444
Siberian Kuybyshev (Aralichevskiy Rayon) coal	T	8,250	6,690	0.372	0.356

Tables 2 and 3 show the equivalents for fuel for (1) hand-fired locomotives in relation to 7,000-calorie equivalent fuel, applicable for fireboxes with standard grates having a small useful section and with standard domes, and (2) petroleum, the fireboxes having a lining and a dome with an overlapping of 60 percent, with Z_{KH} (number of kilograms of steam brought to a heat content of 640 calories per kilogram, produced per square meter of heating surface per hour) equaling 50 kilograms per square meter per hour.

Table 2. Liquid Fuel

<u>Fuel</u>	<u>Engler</u>	<u>QH</u>	<u>QH</u>	<u>TK</u>	<u>Э</u>
Firebox mazut	20-40	9,810	9,590	0.740	1.014
Firebox mazut	60-80	9,690	9,470	0.691	0.935

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Table 3 Coals

<u>Fuel</u>	<u>Type</u>	<u>Q_h</u>	<u>Q_h</u>	<u>η_k</u>	<u>γ</u>
<u>Group 1. Brown Coals (Moscow type)</u>					
Tovarkovskiy coal	BK, BR, BO	6,314	2,900	0.578	0.240
Pobedinskiy coal	BK, BR, BO	6,530	3,160	0.578	0.261
Borbizhovskiy coal	BK, BR, BO	6,372	3,978	0.578	0.246
Obolenskiy coal	BK, BR, BO	6,343	2,873	0.578	0.237
Shchekino coal	BK, BK, <u>[sic]</u> BO	6,440	2,987	0.540	0.230
Avg quality coal	BK, BR, BO	6,433	3,013	0.578	0.249
Ural Bogoslovskiy coal	BR	6,280	3,650	0.578	0.301
Ural-Chelyabinsk coal	BK, BR	6,710	4,130	0.585	0.345
Central Asia Kizil-Kiya coal	B	6,600	4,310	0.540	0.332
Srednyaya Sulyukta coal	B	6,790	4,920	0.540	0.379
Sredniy Shurab coal	B	6,655	4,135	0.530	0.319
Karaganda-Fedorovskiy coal	BR	6,855	4,520	0.585	0.379
Siberian Chernovskiy Tarbagatay coal	B	6,980	4,770	0.585	0.400
Siberian Chernovskiy Tarbagatay coal	B	6,805	3,870	0.578	0.320
Far East Artem coal	BK, BR, BO	6,530	3,922	0.578	0.234
Far East Kivdinskiy coal	BK, BR, BO	6,155	3,118	0.540	0.245
Far East Raychikhinsk coal	BR, BK, BO	6,248	3,367	0.540	0.260
Far East Tavrichanka coal		6,880	4,890	0.578	0.404
Ukrainian Aleksandriya coal		6,165	1,780	0.500	0.127
Ukrainian Kirovskiy coal		6,320	1,485	0.500	0.106
Ukrainian Zvenigorodka coal		6,120	2,080	0.500	0.149
<u>Group 2. Long-Flame Coals</u>					
Donets coal	D	7,340	5,560	0.600	0.477
Central Asia Berchogur coal	D	7,530	4,475	0.580	0.471
Siberian Chernogorodskiy (Khakass) coal	D	7,420	5,760	0.600	0.494

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Table 3 (contd)

<u>Fuel</u>	<u>Type</u>	<u>Q_H</u>	<u>Q_L</u>	<u>η_κ</u>	<u>η</u>
Siberian Chermkhovo coal	D	7,420	5,660	0.600	0.485
Siberian Leninsk (Kol'-chugino) coal	D	7,400	6,275	0.600	0.538
<u>Group 3. Gas Coals</u>					
Donets coal	G	7,730	6,410	0.615	0.563
Donets coal	Gp/k	7,610	5,770	0.600	0.494
Ural Kizelovskiy coal	G/PZh	7,830	5,990	0.600	0.488
Transcaucasus Tkvarcheli coal	G/PZh	7,880	4,980	0.580	0.409
Transcaucasus Tkvarcheli coal	G	7,340	4,730	0.580	0.392
Central Asia Kok-Yangak coal	G	7,250	5,180	0.580	0.425
Central Asia Chok-pakskiy coal	G	7,700	6,400	0.615	0.562
Siberian Leninsk (Kol'chugino) coal	G	7,880	6,765	0.615	0.594
Siberian Bukachacha coal	G/PZh	7,450	5,735	0.600	0.492
Spitzbergen coal	G	7,915	6,445	0.600	0.552
<u>Group 4. Steam-Fat Coals</u>					
Donets coal	PZh	8,060	6,710	0.660	0.633
Donets coal	PZhp/k	8,015	6,240	0.630	0.562
Donets coal	K	8,140	6,390	0.655	0.598
Siberian Kemerovo coal	PZh	8,205	6,950	0.660	0.655
Siberian Oginovskiy coal	PZh	8,080	6,635	0.660	0.625
Far East Suchan coal	---	8,070	6,505	0.660	0.613
Karaganda coal	PZh, K	8,030	5,710	0.660	0.538
<u>Group 5. Steam Sintering Coals</u>					
Donets coal	PS	8,220	6,830	0.650	0.634
Donets coal	PSp/k	8,245	6,624	0.625	0.591

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Table 3 (contd)

<u>Fuel</u>	<u>Type</u>	<u>QH</u>	<u>QH</u>	<u>ηκ</u>	<u>η</u>
Siberian Anzhero-Sudzhensk coal	PS	8,340	7,225	0.650	0.671
Siberian Kiselevsk coal	SS	8,980	6,870	0.625	0.613
Siberian Kemerovo coal	PS	8,160	6,810	0.650	0.632
Siberian Prokop'yevsk coal	SS	8,011	6,795	0.625	0.607
Karaganda coal	PS	8,010	6,210	0.650	0.577
<u>Group 6. Lean Coals</u>					
Donets coal	T	8,230	7,210	0.577	0.594
Siberian Kuybyshev (Aralichev-skiy Rayon) coal	T	8,250	6,690	0.577	0.551
<u>Group 7. Briquettes</u>					
Donets briquette	Mospino station	8,320	7,570	0.610	0.660
Donets briquette	Khanzhenkovo station	8,380	7,790	0.610	0.679
Donets briquette	Yenakiyevo station	8,290	6,980	0.600	0.598
<u>Group 8 Anthracites</u>					
Donets anthracite	AP, AP [sic]	8,040	7,180	0.630	0.646
Donets anthracite	AM	8,000	6,690	0.597	0.571
Donets anthracite	ARSh	7,970	6,590	0.571	0.538
Donets anthracite	AS	7,980	6,580	0.402	0.378
Donets anthracite	ASSh	7,430	6,410	0.402	0.368
Ural Yegorshino anthracite	AR	8,030	6,150	0.571	0.502
Ural Bredy anthracite	---	7,840	5,755	0.571	0.469
<u>Group 9. Shales</u>					
Veymarnskiy shales	---	6,288	2,578	0.500	0.284
Gdov shales	---	7,990	2,170	0.500	0.155

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Table 3 (contd)

<u>Fuel</u>	<u>Type</u>	<u>Q_H</u>	<u>Q_H^P</u>	<u>η_K</u>	<u>γ</u>
Kashin shales	----	6,500	1,710	0.480	0.117
Undorskiy shales	----	5,500	1,733	0.580	0.119
Savel'yevdkiy shales	----	6,490	1,650	0.480	0.113
<u>Group 10.</u>					
Material from smokeboxes of steam locomotives	----	7,800	4,000	0.289	0.165

Table 4. Wood and Peat

<u>Fuel</u>	<u>Quantity of Useful Calories Cu M of Wood</u>	<u>η_K</u>	<u>γ (Volume)</u>
<u>Group 1. Wood (by volume)</u>			
With 25% moisture content			
Deciduous	1,236,655	0.588	0.105
Coniferous	1,186,335	0.550	0.093
Mixed	1,238,965	0.558	0.099
With 35% moisture content			
Deciduous	1,199,960	0.581	0.100
Coniferous	1,152,330	0.540	0.089
Mixed	1,203,320	0.546	0.094
With 45% moisture content			
Deciduous	1,149,625	0.571	0.094
Coniferous	1,106,600	0.530	0.084
Mixed	1,154,925	0.537	0.088

<u>Fuel</u>	<u>Q_H</u>	<u>Q_H^P</u>	<u>η_K</u>	<u>γ (Weight)</u>
<u>Group 2. Wood (by weight)</u>				
With 25% moisture content				
Deciduous	4,420	3,115	0.588	0.262
Coniferous	4,555	3,215	0.550	0.253
Mixed	4,510	3,185	0.558	0.254

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Table 4 (contd)

<u>Fuel</u>	<u>Q_H</u>	<u>Q_F</u>	<u>η_K</u>	<u>Σ (weight)</u>
With 35% moisture content				
Deciduous	4,420	3,620	0.581	0.217
Coniferous	4,555	2,705	0.540	0.208
Mixed	4,510	2,680	0.546	0.209
With 45% moisture content				
Deciduous	4,420	2,125	0.571	0.178
Coniferous	4,555	2,200	0.530	0.166
Mixed	4,510	2,175	0.537	0.167
<u>Group 3</u>				
Fagots	4,420	2,826	0.400	0.162
Haloxylon (straw)	4,555	3,210	0.500	0.230
Machine-cut peat with 30% moisture content	5,335	3,220	0.530	0.244
Machine-cut peat with 45% moisture content	5,335	2,400	0.500	0.171

APPENDIX

In the tables, types of coal designated by letters are as follows:

B (buryy) - brown coal. Since Moscow area coal has relatively constant qualitative characteristics, it is subdivided only according to size, as follows:

K (krupnyy) - large

O (orekh) - nut

MS (meloch's semyachkom) - fines with pea size

R (ryadovoy) - run-of-the-mine.

D (dlinnoplamenny) - long-flame

G (gazovyy) - gas.

PZh (parovichno-zhirnyy) - steam-fat.

K (koksovy) - coking.

PS (parovichno-spekayushchiysya) - steam-sintering.

SS (slabospekayushchiysya) - weakly sintering.

T (toshchiy) - lean.

A Anthracite

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AP (plitnyy) - slab

AK (krupnyy orekh) - large nut

AM (melkiy orekh) - small nut

AR (ryadovoy) - run-of-the-mine.

AS (semyachko) - pea

ARSh (ryadovoy so shtybom) - run-of-the-mine with dross

ASSh (semyachko so shtybom) - pea with dross

p/k indicates a mixture of slab and large nut.

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